

## *Aptosyax grypus*, a New Genus and Species of Large Piscivorous Cyprinids from the Middle Mekong River

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**Abstract** A new genus and species of cyprinid fishes, *Aptosyax grypus*, is described from the middle Mekong River of Laos and Thailand. This large and rarely seen species reaches a full meter in length and lives in the main stem of the river. The species is a piscivore and the southernmost representative of the aspiin lineage. Among the aspiins it is unique in having a well-developed adipose eyelid and large symphyseal knob on the mandible which fits into a deep notch in the upper jaw.

A lineage of large, piscivorous cyprinids has been examined recently by Howes (1978, 1984). The group is predominantly Asiatic in distribution, and has close relatives in the western hemisphere. The "aspinine group" of Howes (1978, 1984), part of the Palaearctic cyprinid subfamily Leuciscinae, includes at least six genera, all monotypic, with one having two subspecies. The monotypic genera of the Aspiini are, for the most part, a series of distinctive, highly modified predators, which could be grouped together in multi-species genera only with extreme difficulty, if at all. The distribution of the Aspiini covers most of Europe, extending southeast into the Tigris-Euphrates and eastward into the drainages of the Aral Sea. Eastward through central Asia, isolated aspiins are found in the Tien Shan and Mongolia. Several genera of aspiins are found throughout eastern Asia, from the Amur River in the southeastern part of the Soviet Union, southwards to the Red River of Vietnam. According to Howes (1984), these genera may be closely related to *Tribolodon* of eastern Asia which is, in turn, related to the cyprinid genera *Pogonichthys* and *Ptychocheilus* of western North America. The relationships of the western North American cyprinids may be elucidated after an examination for aspiin, or near-aspiin, characters (Howes, 1984). Until discovery of the new genus described here, no aspiins had been found south of the Tonkin Gulf drainages of Vietnam, making this the first aspiin to be found in the South Asian region as defined by Bănărescu (1972).

### Materials and methods

A series of 29 measurements and 14 counts were

taken on the new species. Of the measurements, 14 were made on the body and fins, and 15 were taken on the head, mostly following Hubbs and Lagler (1958). The abbreviation "SL" refers to standard length. All specimen measurements were taken on dial calipers using individuals while they were still in formalin. These fishes contracted noticeably when placed in alcohol. Based on photographs of freshly caught individuals, the proportions of formalin specimens more closely resembled the expected proportions of living specimens than did the alcohol specimens. Only seven specimens were measured while still in formalin, and it was decided that the measurements would not be mixed with measurements of alcohol specimens. The drawing of the largest juvenile was made from the tracing of a photograph taken on the day of capture. Therefore, the proportions are those of a fresh specimen rather than of an alcohol specimen.

Descriptive statistics, such as means and unbiased standard deviations (Table 1) were calculated according to Sokal and Rohlf (1969). Allometric coefficients (Strauss and Bookstein, 1982; Bookstein et al., 1985) were calculated twice, first excluding and then including the large holotype. This was done to determine whether the allometric trajectories found among the juveniles (of 145 mm SL maximum) were the same as the trajectories found during the development from juveniles to large adults (of 720 mm SL maximum). For the allometric coefficients, values of less than 0.97 signify relative negative allometry, whereas scores between 0.97 and 1.03 indicate relative isometry, and values greater than 1.03 reflect relative positive allometry.

Vernacular names are transliterations of Thai or



Fig. 1. Photographs illustrating the lateral views of the whole body (above) and of the head (below) taken of 721 mm SL holotype for *Aptosyax grypus*.

Lao names and are given in quotation marks. Institutional abbreviations are listed in the acknowledgments.

*Aptosyax* gen. nov.

**Generic diagnosis.** Large cyprinid fishes having a generally fusiform shape (Fig. 1, top), with slight lateral compression increasing posteriorly. Cranium broad, with head width decreasing ventrally. Frontal-parietal fenestra in small specimens, limited to parietals in larger specimens, possibly closing entirely in large adults. Lower jaw heavy (Fig. 1, bottom), with symphyseal knob that fits into a median slot at the tip of the upper jaw. Upper jaw barely pro-

tractile, if at all. Gill membranes nearly free, fused far forward on the isthmus. Low number of long curved gill rakers. Adipose eyelid well developed, covering one third of the eye. Lateral line system well developed, with high numbers of pores. Lateral line canal has at least six pores on nasal bones, and after joining with infraorbital canal, extends forward nearly to tip of snout. Infraorbital 3 enlarged posteriorly, extending across one third of the cheek. Infraorbitals 4 and 5 greatly reduced, with 5th being a hollow bony tube, one or both having a tendency to fragment at lateral line pores, producing supernumerary elements. Genus monotypic.

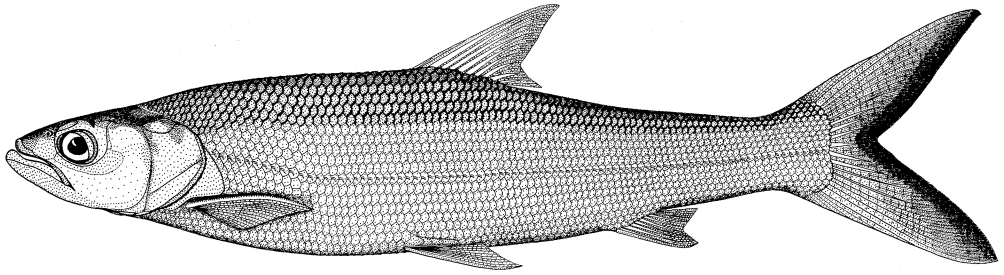


Fig. 2. Illustration of the largest (145 mm SL) juvenile specimen of *Aaptosyax grypus*. Specimens in this stage of development are encountered much more often than adults.

*Aaptosyax grypus* sp. nov.  
(Figs. 1–3)

*Opsariichthys* sp. Serene, 1951: 10 (natural history, local name, Vientiane).

**Material examined.** **Holotype.** THAILAND: CAS 76031 (1, 721 mm standard length), Mekong River at Khong Chiam Dist., Ubon Ratchathani Prov., coll. T. Roberts, 27 XII 1988.

**Paratypes.** THAILAND: UMMZ 214881 (1, 145 mm), Mun River, 4 km upstream from Mekong River confluence, Khong Chiam Dist., Ubon Ratchathani Prov., Thailand, coll. Songrad for Mekong Basinwide Fishery Studies (MBFS), 22 VI 1975; UMMZ 209086 (5, 56–102 mm), Mekong River, Khong Chiam Dist., Ubon Ratchathani Prov., coll. J. Karnasuta; UMMZ 214882 (2, 42 and 53 mm), Mekong River at Ban Bung Khi Lek, 6 km downstream from Khemerat, Ubon Ratchathani Prov., coll. S. Sairaj and Y. Dhammibavorn for MBFS, 9 IV 1975; UMMZ 214883 (1, 71 mm), Mekong River at Ban Tha Kai, 20 km downstream from Mukdahan, Nakhon Phanom Prov., coll. W. J. Rainboth and E. D. Buskirk for MBFS, 17 IV 1975; UMMZ 214884 (2, 72 and 103 mm), Mekong River, 16.5 km downstream from Mukdahan, Nakhon Phanom Prov., coll. E. D. Buskirk for MBFS, 18 IV 1975; UMMZ 214885 (1, 105 mm), Mun River, 4 km from Mekong River confluence, Ubon Ratchathani Prov., coll. Songrad for MBFS, 4 VII 1975.

**Description.** This fish is nearly fusiform anteriorly, becoming progressively more laterally compressed posteriorly. In lateral aspect, the dorsal and ventral profiles are similarly convex. In trunk cross section, the dorsum and ventrum are smoothly rounded, neither one developing a sharp median ridge. In adults, the anterior fin-rays become elongated, and the fin assumes a falcate margin not found in juveniles. Juvenile coloration in life green above, with the lower three quarters of the body bright silver. In adults, the body is mostly bluish silvery

with the dorsum darkened slightly. In the single large individual, all of the scales of the trunk are bordered by a fine black margin, giving a reticulated melanin pattern that extends to the middle of the ventral surface. The head is dark above with upper jaw darkened also. The distal margin of the caudal fin is occasionally darkened to black in individuals from clear water (Fig. 2).

The fin-ray counts are; dorsal iv-9, anal iii or iv-8 or 9, pectoral i-15 to 17, pelvic i-10. The caudal fin has 10/9 (total 19) principal rays. The last unbranched dorsal ray is neither ossified or enlarged, but rather it is segmented throughout its length. Vertebral counts are; 4 Weberian, 16 thoracic, 11 transition, 19 caudal, totalling 50. There are 10 rod-like supraneurals. The scales are small, and deciduous, with 74 to 85 pored scales in the lateral line, 36 to 42 in the predorsal midline, 24 to 26 circumpectuncular, 46 to 48 circumferential, and 14 to 15/1/9 or 10 in lateral transverse series.

For specimens ranging in size from 56 to 145 mm SL, as well as the large holotype, the ranges, means and standard deviations of the various body and head proportions have been tallied (Table 1). The great size difference between most of the individuals and the large holotype is reflected in the number of proportions for which the large individual is an outlier (19 out of 28 proportions). The notable changes in shape of the large adult, for the most part, follow the pattern already established in the smaller specimens (Table 1). The addition of the adult specimen causes few changes in direction of allometry, although some trends increase or decline. One head measurement did change, and the change in gape width from relative isometry in juveniles (0.99) to positive allometry when the adult is included (1.16), reflects a broadening of the lower part of the head, a trend that no other measurement was po-

sitioned to capture. In general, with fin measurements, except for the caudal fin, there is higher positive allometry when the adult is included, because of the extended growth of the anterior fin-rays.

The gill rakers are long, slender, curved points, of fairly low number, from 10 to 12 on the ceratobranchial and 1 to 3 on the epibranchial, totalling 11 to 15. The pharyngeal arch is long and slender, with the ventral (anterior) arm strongly compressed, and three rows of long hooked teeth in 5-3-1 arrangement. The single tooth on the inner row is displaced anterolaterally, almost giving the appearance of a two-rowed 5-4 pattern. The intestine is much shorter than the length of the body and has a short single loop, the simplest pattern found among cyprinids (Kafuku, 1958, 1975). The large bipartite swim-bladder extends the entire length of the body cavity,

with the second chamber terminating directly above the vent.

The lateral line system is highly developed, with many pores on all head canals, particularly the mandibular canal with 17 pores (Fig. 3). The infraorbital canal posterior to the eye is vertical in juveniles, but becomes oblique in adults (Fig. 1, bottom). There are 6 or 7 pores on the lateral line canal of the nasal bones, and over a dozen pores on the canal of the frontal bone. Anterior to the nasal bones, the canal continues nearly to the tip of the snout. These pores and canals are easy to find in the juveniles but are tiny and difficult to find in the adult. In juveniles, each lateral line scale has a single ventrally deflected pore, with additional pores appearing on each scale as the fish grows. The large adult specimen has highly arborescent canal patterns with

Table 1. Proportional measurements of *Aptosyax grypus*, with body and fin measurements (1-14) given as percent of standard length, and head measurements (15-28) listed as percent of head length. Minima and maxima include all measured juvenile specimens, ranging standard length from 56 to 145 mm. The adult holotype (HT), is 721 mm in standard length and has been tallied as a separate column. Mean and standard deviation (SD) columns include the holotype. First column of allometric coefficients (AC1) includes juveniles only, and the second column (AC2) includes the large adult holotype along with the juvenile specimens.

	Min	Max	HT	Mean	SD	AC1	AC2
1. Head length	25.09	29.25	21.93	26.99	2.66	0.94	0.93
2. Preanal length	69.50	72.3	72.26	71.11	1.12	1.10	1.06
3. Predorsal length	49.47	50.59	47.99	49.79	0.91	1.09	1.03
4. Prepelvic length	48.45	50.59	45.91	49.24	1.69	1.07	1.01
5. Prepectoral length	24.05	28.01	20.80	25.59	2.55	0.93	0.93
6. Body depth	17.62	20.33	23.87	19.64	2.11	0.85	0.89
7. Peduncle depth	6.58	8.15	8.82	7.53	0.82	1.31	1.16
8. Peduncle length	17.68	25.63	19.75	19.71	2.72	1.06	1.05
9. Caudal fin length	26.33	31.03	22.01	27.03	2.73	0.97	0.94
10. Dorsal fin height	18.61	21.63	18.88	19.86	1.06	0.96	1.01
11. Anal fin height	11.49	14.19	13.09	12.95	0.94	0.95	1.04
12. Pectoral fin length	14.73	15.96	15.89	15.44	0.48	1.05	1.06
13. Pelvic fin length	14.54	16.04	15.19	15.23	0.62	1.01	1.04
14. Axillary scale length	3.59	5.50	5.94	5.13	0.75	1.30	1.15
15. Preoccipital length	72.26	79.25	68.18	74.02	3.74	0.85	0.89
16. Snout to preopercle	75.29	79.87	75.90	76.62	1.48	0.92	0.93
17. Snout length	26.28	28.49	25.17	27.12	1.11	0.88	0.89
18. Prenasal length	20.60	22.64	20.75	21.28	0.69	0.86	0.91
19. Orbit width	20.88	28.30	14.23	23.32	4.84	0.60	0.67
20. Interorbital width	27.59	30.49	37.07	29.79	3.35	1.03	1.05
21. Internasal width	15.72	20.05	22.90	18.16	2.64	1.21	1.08
22. Head width at preopercle	39.25	45.62	54.08	43.86	4.99	1.06	1.05
23. Gape width	16.67	19.71	30.68	19.70	4.94	0.99	1.16
24. Mandible length	43.96	51.57	37.44	46.63	4.93	0.78	0.81
25. Upper jaw length	37.23	44.09	37.00	40.58	3.07	0.77	0.87
26. Head depth at nostril	29.57	32.76	34.72	31.90	1.67	0.89	0.97
27. Head depth at pupil	42.03	47.17	44.21	44.63	1.74	0.89	0.92
28. Head depth at occiput	55.11	59.12	65.46	57.68	3.67	0.91	0.99

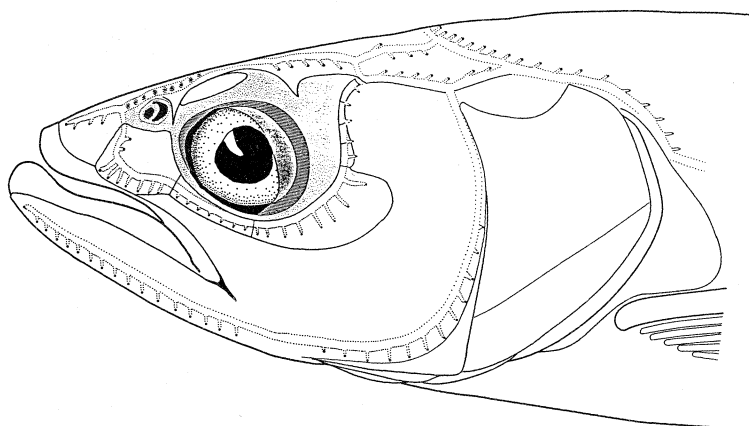


Fig. 3. Illustration of the highly developed cranial lateralis system in the 145 mm SL juvenile specimen of *Aptosyax grypus*.

up to 10 branches on each scale of the lateral line.

**Relationships.** The genus *Aptosyax* belongs to the group of large predatory aspiin cyprinids discussed by Howes (1978, 1984). Although I have not attempted to produce a complete osteological account, it is possible to discern several important characteristics from radiographs. Radiograph information, along with observations on the external morphology indicate that the relationships of the genus *Aptosyax* are with the aspiins. At the same time, the species *Aptosyax grypus* has an assortment of unique characters, as well as an absence of generic characters for other aspiins that makes it impossible to place the new species in any other existing genus.

Among the characteristics *Aptosyax* shares with the aspiins are those relating to the vertebrae, lateralis system, circumorbital bones, and squamation. The new genus has a high number of vertebrae (50), one less than the minimum given by Howes (1978) for five aspiin genera, which ranged from 51 to 55. The only other cyprinid genera for which Howes tallied 50 or more were *Pelecus* (52) and *Ochetobius* (60–61). The number of caudal vertebrae in *Aptosyax* is 19, a rather low number for a large cyprinid, although counts of aspiin caudal vertebrae are not generally higher than many other cyprinid genera. It is with abdominal vertebrae that the aspiins have comparatively higher counts than other cyprinids, and *Aptosyax* has a count of 27 non-Weberian abdominal vertebrae, which is at, or slightly above, the median number of abdominal vertebrae found in aspiins (Howes, 1978). Aspiins do not have a posteriorly displaced dorsal fin, and consequently

do not have particularly high numbers of supraneurals, however the supraneurals are thin and rod-like, as is the case with *Aptosyax*.

On the head, high numbers of lateral line pores are found on the canals of the nasal and frontal bones, a characteristic that is similar to aspiins. The mandibular canal has 17 pores, a count high even for aspiins, which have the highest counts among cyprinids. The circumorbital canal posterior to the eye is oblique rather than vertical in aspiins, and in *Aptosyax* the canal is vertical in juveniles becoming oblique in adults as the postorbital part of the head lengthens.

One of the more notable aspiin characters is the reduction in caudal fin rays from the 19 principal rays, a count that is almost non-varying among all cyprinids (Roberts, 1973), to the 18 principal rays found in all aspiins according to Howes (1978), who stated that he found counts of 9+9 (or 18) "in all genera examined." *Aptosyax grypus* has 19 principal caudal rays, but the retention of the plesiomorphic character state is uninformative. Both *Ptychocheilus* and *Pogonichthys* have 19 principal rays. Thus *Pogonichthys*, which was included in the aspiins by Howes (1984), also has the plesiomorphic character state. Interestingly, this character was completely overlooked in Howes (1984) such that no count was even given for the new genus *Genghis* described in that paper. With all members of the main lineage of aspiins having 18 principal rays, it would be interesting to know the count for *Genghis*, which was hypothesized to be the sister taxon to that lineage (Howes, 1984). This has bearing on the relationship



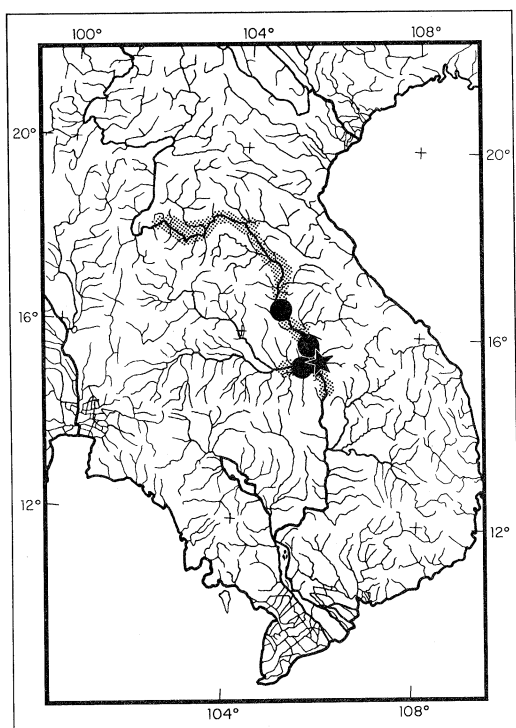


Fig. 4. Map of the range of *Aptosyax grypus* in the Mekong River of the Indochinese Peninsula. The star indicates the type locality, and circles show localities of other specimens examined. The reported range of the species is stippled.

of *Aptosyax* to the aspiins, because it is doubtful that such a character so conservative for thousands of cyprinids would change twice in parallel within one lineage.

Although the *Aptosyax grypus* is undoubtedly an aspiin, each potential aspiin congener lacks important characters found in the new species, such as the well-developed adipose eyelid, or the pronounced symphyseal process and enlarged dorso-lateral border in the dentary. The development of the lower jaw is reminiscent of *Opsariichthys* rather than any aspiin. The most likely candidate for congeneric status is *Elopichthys bambusa*, but the beak-like fusion of upper jaw elements in *Elopichthys* appears to be quite different from the deep median notch in the upper jaw of *Aptosyax*.

**Natural history.** This species grows to large size, reaching a maximum length of 1 meter (Serene, 1951). It frequents the main course of the middle Mekong River and has been found in the lower course of the Mun River, the major drainage of the

Korat Plateau in eastern Thailand (Fig. 4). This rare species has a range in the Mekong from Vientiane to the Mun River mouth. The species apparently breeds in March and April, just prior to the rainy season. All of the paratypes used in this description probably represent young of the year. During the Mekong Basinwide Fishery Studies, several specimens were obtained, all as parts of randomly subsampled commercial haul seine catches. All specimens obtained in 1975 were juveniles, and no adults were caught or seen at markets. Juveniles were also collected by Dr. Yasuhiko Taki in the same region (personal communication). The holotype is the only known adult specimen and its age is eleven years, based on annual erosion patterns of the anterior and lateral field scale circuli.

**Taxonomy.** *Aptosyax grypus* is probably the species reported under the name of *Opsariichthys* sp. by Serene (1951). *Opsariichthys* has not been found in the Mekong, but has a long, curved lower jaw, possessing a large symphyseal process reminiscent of the lower jaw of adult specimens of *Aptosyax grypus*. In the Mekong, the only other likely candidate for misuse of the name *Opsariichthys* is *Raiamas guttatus* which was also reported by Serene and given an appropriate maximum size of 300 mm, rather than the maximum size of 1 meter given for *Opsariichthys* sp. Serene (1951) stated that the local name of this large fish is "Pa sa nak", and that among the large fishes it is especially voracious as well as rare. According to Serene, *Raiamas guttatus* has a different local name "Pa hao", and is a common species. Serene also indicated that both *Raiamas guttatus* and *Aptosyax grypus* spawn in March and April. Taki (1974) later applied the local name "Pa sa nak" to *Raiamas guttatus*, but he may have obtained that name from someone unfamiliar with the larger species, *Aptosyax grypus*. Dr. Tyson Roberts (personal communication) indicated that the Thai name for the large specimen is "Pla chanak", which has vowels pronounced in a manner similar to the Lao name quoted by Serene.

**Etymology.** The name *Aptosyax* translates to "invincible fish", and is derived from the Greek adjective *aptos*, meaning invincible, and the Greek noun *syax*, gender masculine, meaning fish. The Greek adjective *grypos* has been latinized to *grypus* translates to "curved" or "hook-nosed", and refers to the strongly curved jaws.

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# Literature cited

- Bănărescu, P. 1972. The zoogeographical position of the East Asian fresh-water fish fauna. *Rev. Roum. Biol. Zool.*, 17(5): 315-323.
- Bookstein, F. L., B. Chernoff, R. L. Elder, J. M. Humphries, G. R. Smith and R. E. Strauss. 1985. Morphometrics in evolutionary biology: the geometry of size and shape change, with examples from fishes. *Acad. Nat. Sci. Philadelphia, spec. pub.* 15: xvii + 277.
- Howes, G. J. 1978. The anatomy and relationships of the cyprinid fish *Luciobrama macrocephalus* (Lacépède). *Bull. Brit. Mus. Nat. Hist. (Zool.)*, 34(1): 1-64.
- Howes, G. J. 1984. Phyletics and biogeography of the

- aspinine cyprinid fishes. *Bull. Brit. Mus. nat. Hist. (Zool.)*, 47(5): 283-303.
- Hubbs, C. L. and K. F. Lagler. 1958. Fishes of the Great Lakes region. *Bull. Cranbrook Inst. Sci.*, 26: xi + 213.
- Kafuku, T. 1958. Speciation in cyprinid fishes on the basis of intestinal differentiation, with some references to that among the catostomids. *Bull. Freshwater Fish. Res. Lab.*, 8: 45-78.
- Kafuku, T. 1975. An ontogenetical study of intestinal coiling pattern on Indian carps. *Bull. Freshwater Fish. Res. Lab.*, 27: 1-19.
- Roberts, T. R. 1973. Interrelationships of ostariophysans. Pages 373-395 in P. H. Greenwood, R. S. Miles & C. Patterson, eds. *Interrelationships of fishes*. Academic Press, London & New York.
- Serene, R. 1951. Sur la faune ichthyologique du Laos. *Indo-Pacific Fisheries Council Technical Papers. IPFC/C51/TECH* 49, 25 pp.
- Sokal, R. R. and F. J. Rohlf. 1969. *Biometry: the principles and practice of statistics in biological research*. xiii + 776. W. H. Freeman, San Francisco.
- Strauss, R. E. and F. L. Bookstein. 1982. The truss: body form reconstruction in morphometrics. *Systematic Zoology*, 31(2): 113-135.
- Taki, Y. 1974. Fishes of the Lao Mekong basin. *U.S.A.I. D. Mission to Laos*, vi + 232.

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## メコン河中流から得られた大型魚食性コイ科の新属新種 *Aptosyax grypus*

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ラオスおよびタイのメコン河中流から得られた標本に基づきコイ科の新属新種 *Aptosyax grypus* を記載した。本種は1m以上に達する大型希種で河川本流に生息する。また魚食性であり、アスピウス系種としては最南端に分布する。アスピウス系としては、よく発達した脂腺をもち、上顎の深いノッチにおさまる縫合部突起を下顎にもつことでユニークである。